Probably many outside of America have an exaggerated idea of the extent and meteorological importance of the tornadoes to which Mr. Lyons refers. On the 28th and 29th thunderstorms were certainly more numerous over the United States, as a whole, than on the other dates of the month, and yet, both the 2d and the 31st were nearly as conspicuous. Three groups of tornadoes formed along the ninety-ninth meridian on the 27th, about 6 o'clock p. m., central time, and moved eastward. Similarly, on the 28th, small tornadoes occurred in Iowa. On the 29th a squall in Buffalo; on the 30th, tornadoes in South Dakota, Nebraska, Missouri, and Iowa, the latter passing eastward into Illinois.

If we think of the 27th–31st as a period during which there prevailed in the United States an area of thunderstorms and tornadoes that had occupied ten days in moving eastward from the Sandwich Islands, then we must, of course, expect these disturbances to have been observed, or at least felt, at some intermediate point, otherwise we should have no reason whatever to connect these two distant localities together. Now, the fact is that the daily weather maps, the reports of the various State sections for the month of May, the reports of vessels from the ocean, and the daily newspapers agree in showing no special frequency of thunderstorms, tornadoes, waterspouts, auroras, or any other atmospheric disturbances over the whole tract of 70° in longitude, or 4,000 miles, between the Sandwich Islands and the Mississippi Valley. We must, therefore, for the present, withhold acquiescence in the conclusion expressed by our distinguished correspondent. An examination of the Honolulu record for May shows that an area of low pressure existed near that region on the 18th. It probably passed westward, in accordance with the usual movements in this part of the Pacific, and could, therefore, hardly be expected to reach the Mississippi Valley in ten days. If, however, it was not a well-defined cyclonic system, but simply the western end of a long trough of low pressure, then, indeed, the disturbances at Honolulu and in the Mississippi Valley might be due to the same ultimate cause, although neither one produced the other.

We believe most firmly that the weather in any one part of the world depends in part upon what is transpiring in distant regions. A hurricane in the West Indies and cool northerly winds over the Atlantic States; a cold wave in Florida preceded by a blizzard in Montana; drought in Great Britain, preceded by droughts in the United States, and these preceded by droughts in India, are cases in point. The precise nature or mechanics of these connections will be unravelled as meteorology advances. We hope that Mr. Lyons will communicate to the MONTHLY WEATHER REVIEW some account of his studies on this subject.

DO LOCAL STORMS FOLLOW RIVER VALLEYS?

Dr. Samuel D. Irwin, of Tionesta, Forest County, Pennsylvania, under date of July 27, communicates the following case:

One of the heaviest rainfalls for many years occurred here on Tuesday night, 25th inst., between 7 p. m. and 12 o'clock, there being a fall in five hours of 8 inches, according to others of 7.50 inches, but most who observed put it at 8 inches. This rain was local in its character. It washed out streets and alleys on the side hill and caused much damage.

There was but little thunder and lightning. The next day, Wednesday, was "as clear as a bell," as well as to-day, with the exception of a few floating clouds early in the morning. On the 26th of June there was also a very heavy dash of rain in the forenoon about 10 o'clock which lasted nearly an hour and a half, it seemed to pour down, many thought it was a cloudburst, which is an indefinite term; the oldest inhabitant never knew it to rain so hard for so short a time in this section, the rainfall on that day was 5 inches, much like this last rain in character, accompanied by but little thunder and lightning. One remarkable feature of this June rain was that it did not cover a belt of over 6 miles north and south of Tionesta Borough, as was ascertained, it did much damage to roads and bridges, causing washouts of three small bridges on one road alone.

At this place, Tionesta Creek, a considerable stream joins the Allegheny River, coming in directly east, while the general course of the river is from north to south, which in the opinion of some seems to verify the theory that the rain clouds follow the streams to a considerable extent, at least this seems to be the case in the whole extent of the upper Mississippi valley.

Can the further progress of this storm be traced so as to show whether the part here described was but a fragment of its whole history? Can other localities of frequent local rains be found in Pennsylvania? Do not the local rains form rivers and valleys rather than the valleys attract the rains?—ED.

WEATHER BUREAU MEN AS UNIVERSITY LECTURERS.

In continuation of our remarks in the MONTHLY WEATHER REVIEW for June, (page 256), the Editor desires to put on record all that is being done by Weather Bureau officials in the way of lectures and instruction in colleges and universities in the departments of climatology and dynamic meteorology. The following items will show the thoroughness with which some of our co-laborers present these subjects to their students.

Mr. J. Warren Smith, B. S. (Dartmouth, 1888), Section Director, United States Weather Bureau, Columbus, Ohio, delivered a short course in meteorology at the State University, Columbus, Ohio, on Tuesdays and Thursdays during the spring term of ten weeks beginning March 29, 1899. This course was obligatory for the junior class in agriculture and horticulture, but was elective for the students in the college of arts, philosophy, and science. A fee of $5 was paid to the University. The daily weather maps and Davis' Elementary Meteorology were used as text-books. A question box formed an important part of the laboratory equipment. The same course will be given during the winter of 1899–1900 at the request of the trustees of the university.

The object of this course is to open and outline a rational and systematic line of study of the leading facts concerning our atmosphere, of the methods of observing and investigating the daily weather changes, and of the physical laws underlying these changes; thus training the student in scientific methods of investigation, and furnishing the foundation for later studies in advanced meteorology. To encourage the study of the daily weather maps, and to familiarize the student with the work and the reports of the United States Weather Bureau; that he may become more fitted for appointment in the Weather Bureau, or, in private life, may reap more practical benefits from this important branch of the Government service.

Outline of the course.—The actual weather conditions, as found on the weather maps, will be studied from day to day with the theories for these occurrences, the problems found there, and the correlation of the different weather elements as presented in the different parts of our country. An intelligent use of the weather maps for personal weather prediction, with some of the problems presented to the forecaster, will be shown. Weather Bureau instruments will be put in use; and actual and accurate observing, reducing and recording of the different weather elements will be a part of the regular work. Practical work in map and chart making will be carried on.

In the text-book the general relations of the atmosphere and its extent and arrangement about the earth will be first taken up. Then the effect of solar radiation upon atmospheric temperatures, with the distribution of insolation over the earth, conduction and convection in the atmosphere, reflection, absorption, radiation, inversions of temperature, etc., will be considered; to be closely followed by a discussion of the measurement and distribution of atmospheric temperatures over the earth, with the description of the instrument used, and isothermal charts of the earth and of the different countries. One lesson will be given upon the colors of the sky, with the problems of such colors, and upon the atmospheric phenomena of halos, parhelia, etc., in their relation to the probable weather changes, before entering upon the much more complicated discussion of the pressure and circulation of the atmosphere, the general classification of the wind, etc. Under the head of The Moisture of the Atmosphere will be considered evaporation, latent heat, absolute and relative humidity, the formation of

clouds, dew, and frost, prediction of frost, and the protection from frost. The cause, formation, and forward movement of the cyclonic and anticyclonic areas, and of local thunder and hail storms, and of the more severe tornadoes, as they appear on the daily weather maps, will be carefully studied in this part of the course. Attention will then be turned to the causes and distribution of rainfall. The relations between rainfall and agriculture, rainfall and forests, migration of rain belts, and the effect of clouds and rainfall on the general circulation of the atmosphere will be touched upon. The study of the weather and climate, particularly of the United States, will close the course.

Dr. Isaac M. Cline, M. A., M. D., Ph. D., Local Forecast Official and Section Director in the Weather Bureau, is lecturer on climatology in the University of Texas. The course in medical climatology was delivered by him during the winter of 1898–99 weekly to the fourth year students.

The course embraced briefly a description of instruments and methods used in determining climatic conditions and changes; the origin of the atmosphere, its evolution, composition, and offices together with its extent and spherical arrangement; the control of atmospheric temperatures, radiation, insolation, absorption, transmission, conduction and reflection, with particular reference to the manner in which local conditions influence these in making differences in climate; the distribution of temperatures over land and water; the pressure and general wind movements and the ways in which they influence general and local climate; the moisture of the atmosphere, absolute and relative humidity, and sensible temperature of the atmosphere; clouds and sunshine and their distribution; the causes of distribution of precipitation; weather and the control of weather changes, with generalizations as to weather forecasting. Then was taken up the manner in which weather changes and different conditions of climate influence the physiological functions of different organs of the body; the divisions of climates based upon these effects into "low, damp, warm climate," low, damp, cold climate," "high, dry, climate," and intermediate grades; the mineral springs; topographic features and distribution of climate in the United States; the relation of climate to pathology and its influence in the distribution of the more important classes of diseases. Charts and diagrams were used where practicable to illustrate the more important features of the lectures.

Dr. O. L. Fassig, Ph. D., (Johns Hopkins University, 1899), has been instructor in climatology in the department of geology since 1896. His course during the year 1897–98 was twice weekly for two months:

In this course of lectures the topics chiefly considered were: Heat and its distribution over the earth's surface; rainfall and evaporation, their distribution and effects; winds and storms; weather sequences as illustrated by the daily weather charts of the United States Weather Bureau; extent to which topography influences the distribution of the climatic elements; variability of climates; organization and methods in statistical meteorology.

There was also two weeks of field work by the students in a meteorological camp occupied by them in the spring of 1898 in western Maryland.

During the year 1898–99 the following lectures were given, being intended especially for students in geology, medicine, and physics: I. The scope and aim of climatology; the earth's atmosphere; climatic factors. II. Solar radiation. III. The distribution of temperature at the earth's surface. IV. The distribution of atmospheric pressure and the resulting movements of the atmosphere. V. Storms. VI. The moisture of the atmosphere; its visible forms as cloud, rain, snow, dew, fog, etc. VII. Rainfall and its distribution at the earth's surface. VIII. Climates with special reference to the climate of the United States. IX. The daily weather chart. X. Forecasting the weather. XI. The movements of ocean waters and their influence upon climates. XII. Variations in climate, periodic and secular.

During the coming college year, 1899–1900, Dr. Fassig's course will embrace twenty or more lectures on the various aspects of climatology.

The fact that Harvard University accepts an examination in elementary meteorology with original note books of observations and laboratory work as one of the items for admission to Harvard College and the Lawrence Scientific School and as preparatory to higher work in meteorology within the University itself, must greatly stimulate high schools and academies to introduce this subject in their own course of study. An admirable pamphlet of sixteen pages has been published by that University, giving in detail the elementary course of instruction that should be pursued at such academies and further information may be obtained from Mr. R. deC. Ward, Cambridge, Mass.

At some future time the Editor hopes to summarize the instruction given in meteorology by those who are *not* officials of the Weather Bureau.

THE WEATHER AND THE DAIRY.

In the August report of the Virginia Section Mr. E. A. Evans collects together what little is known with reference to the relation of cold weather to the quantity and quality of the milk given by cows. It appears that in general there is a decided diminution in the cream as soon as the weather turns cold, thus justifying the practice of dairymen in keeping the barns artificially heated during cold weather. An interesting case is quoted by Mr. Evans from his own experience in northern Minnesota, in which, although the barn was not artificially heated, yet the cow gave an abundance of rich milk because the ration that was fed to her every evening was hot instead of cold; otherwise the quality and quantity were the same as those given to other cattle.

BALL LIGHTNING.

In the August report of the Utah Section Mr. L. H. Murdoch publishes an account of lightning phenomena that occurred in Salt Lake City in the yard of Senator J. L. Rawlins in Salt Lake City on August 4. This ball is said to have first appeared to be about a foot in diameter, of a ruby red color, entering an open window on the north side of the house. It passed across the hall into the sitting room and out of an open south window, bending and twisting the shrubbery in front of the latter. It then passed southward, tearing up some sod in the yard, and struck a poplar tree about 50 feet distant. The south side of the tree was torn and shattered.

In the usual typical cases of ball lightning very little destruction is reported. The whole phenomenon seems to be confined to the atmosphere and the luminous ball rolls along very slowly. In the present case the tearing up of the sod in the yard and the injury to the poplar tree suggests that after all this may have been only an ordinary discharge of lightning. The doubt would be entirely removed if the observer had stated how many seconds were occupied by the ball in passing from the north side of the house through the latter to the poplar tree.

In the August report of the Maryland and Delaware Section Mr. F. J. Walz publishes a case of ball lightning described by Dr. Stokes, but there is no clear evidence that this differed essentially from an ordinary discharge of lightning.

In former times English writers frequently spoke of a bolt of lightning, or a lightning bolt. This is a figurative expression rather than a descriptive one, and apparently refers to the suddenness of the occurrence. Possibly our observers